A MISSION TO **DISCOVER AND DOCUMENT ALL AUSTRALIAN SPECIES** IN A GENERATION

A mission to discover and document all Australian species—including the estimated 70% of species that remain undiscovered—is both an opportunity and a responsibility. In the face of rapid global change and an accelerating extinction crisis, the mission will help build Australia's path to a sustainable and prosperous future.

The mission will place Australia among the first nations in the world to benefit from a fully documented biodiversity and will enhance Australia's standing as an international leader in managing our environment and shared biological heritage.

A generational project, the mission will combine new technologies such as **machine learning, supercomputing, high-throughput genomics and high-resolution imaging** with the **skills of current and future scientists**, to comprehensively document Australia's biodiversity.

THIS MISSION IS ACHIEVABLE FOR THE FIRST TIME IN HISTORY.

Scientists estimate that 70% of all Australian species of plants, animals, fungi and other organisms remain undiscovered and unnamed. This represents an enormous hidden asset for Australia's future.

Taxonomists sometimes need to access remote areas to collect specimens. Collecting on the Olkola Bush Blitz.
PHOTO: GARY CRANITCH / © QUEENSLAND MUSEUM

MISSION MILESTONES

The mission will be structured as three eight-year campaigns, with an initial focus on building key assets and capabilities. With these assets, a step change in the rate of discovery and documentation of Australia's species becomes possible. Benefits will be up-front and immediate through an early focus on the discovery and documentation of the most strategically important species for biosecurity, bioprospecting, conservation and sustainable development.

Photographing a deep-sea crustacean in the R/V Falkor's wet lab, collected by the ship's remote sub.
PHOTO BY PERMISSION SCHMIDT OCEAN INSTITUTE AND WA MUSEUM

The Western Australian Museum's Glenn Moore collecting a species of *Bryaninops* goby.

Australia's international biodiversity obligations

Australia participates in many regional and global agreements aiming to conserve, sustain and equitably manage our biodiversity. These bring obligations to document and understand all Australian species. Taxonomy—the discovery and documentation of species and other taxa—underpins the *UN Convention on Biological Diversity*, *Convention on the Conservation of Antarctic Marine Living Resources*, *Convention on International Trade in Endangered Species*, and *World Heritage Convention*.

We cannot responsibly manage Australia's globally unique biodiversity while 70% of all Australian species remain unknown and undocumented.

Insect taxonomists collecting flying insects on the Great Victoria Desert Bush Blitz.
PHOTO: © TYRIE STARRS / BUSH BLITZ

KEY ASSET 1
A NATIONAL BIOBANK AND DNA SEQUENCE LIBRARY

Australia's biodiversity is a national asset. Biodiversity tissue samples and DNA sequences are critical to utilising, managing and conserving that asset. A national biodiversity biobank and DNA sequence library will unlock the potential of Australian biodiversity and help secure its conservation.

In some ways, Australia already has a national biodiversity biobank—the collection of more than 70 million scientific specimens in museums and herbaria in every Australian state and territory. These specimens represent a $7 billion national science infrastructure. Many DNA sequences based on these specimens have also been assembled, ranging from DNA 'barcodes' to full genomes. Building a complete national biobank and DNA sequence library is achievable.

To find out more, see
taxonomyaustralia.org.au/mission-biobank

Key Asset 1 will ensure that suitable tissue samples and DNA sequences are available for all known Australian species. This will unlock enormous potential, from eDNA sequencing for environmental monitoring to bioprospecting, bioindustries and bioengineering.

KEY ASSET 2
A WORLD'S-BEST BIODIVERSITY DIAGNOSTICS CAPABILITY

Accurately identifying species is essential if biodiversity is to be managed, utilised and conserved.

Species need to be accurately identified for natural resource management and planning, pest management, biosecurity and quarantine, development approvals, environmental monitoring and assessment, and conservation. Incorrect or delayed identifications can result in multi-million-dollar losses to export industries, agriculture and the environment.

And across Australia, communities interact with, enjoy and value the natural world by being able to identify the fungi, plants, birds, insects, reptiles, mammals, fish and other organisms encountered in their local environment and while travelling.

New technologies provide opportunities for rapid, accurate, timely and accessible species identifications and diagnoses using rapid DNA sequencing, artificial intelligence and online apps using species traits.

Key Asset 2 will be a comprehensive, integrated, highly accessible and world's-best identification and diagnostics capability that will allow anyone, any time, to identify any known Australian species of plant, animal, fungi or other organism.

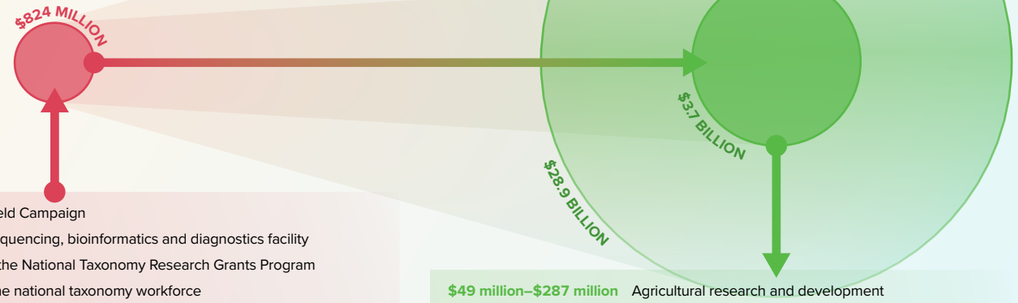
To find out more, see
taxonomyaustralia.org.au/mission-diagnose

Key Asset 2 will revolutionise biosecurity, agriculture and natural resource management, help reduce green tape, and help ensure that conservation programs and efforts are well-targeted and effective. It will also underpin the discovery and documentation of new species, because only by determining that a specimen cannot be identified as a known species can it be determined to be new.

EVERY **$1 SPENT** ON TAXONOMY AUSTRALIA'S MISSION → COULD RESULT IN **$4 TO $35 WORTH** OF **BENEFITS**

TOTAL COSTS ARE ESTIMATED AT **$824 MILLION***

TOTAL BENEFITS RANGE FROM **$3.7 BILLION** TO **$28.9 BILLION***

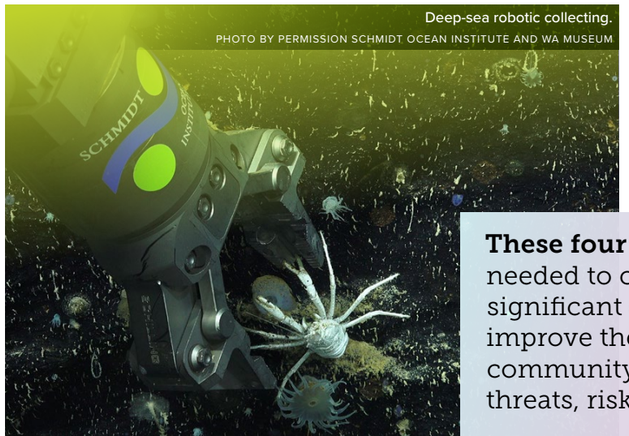


$441 million	National Field Campaign
$124 million	National sequencing, bioinformatics and diagnostics facility
$102 million	Increasing the National Taxonomy Research Grants Program
$73 million	Doubling the national taxonomy workforce
$49 million	Enhanced management and delivery of taxonomy products and services
$33 million	National taxonomy innovation
$31 million	National taxonomic research infrastructure

$49 million–$287 million	Agricultural research and development
$74 million–$372 million	Biodiversity conservation
$465 million–$660 million	Biosecurity diagnostics
$3 billion–$27 billion	Biodiscovery for human health

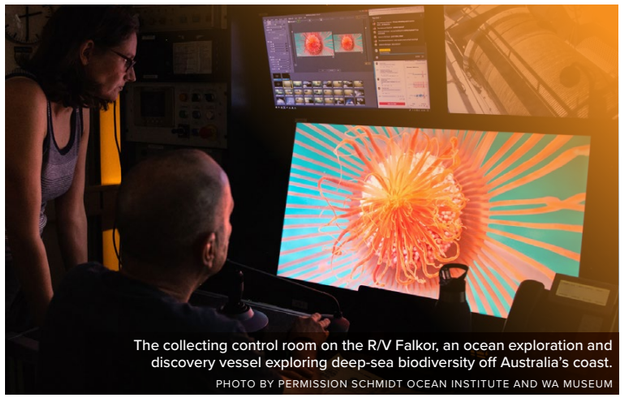
* Net Present Value


Australian museum and herbarium collections are a $7 billion biodiversity infrastructure asset. A specimen of a red alga in the State Herbarium of South Australia.
PHOTO: STATE HERBARIUM OF SOUTH AUSTRALIA



Deep-sea robotic collecting.
PHOTO BY PERMISSION SCHMIDT OCEAN INSTITUTE AND WA MUSEUM

KEY ASSET 3
AN AUSTRALIAN BIODIVERSITY KNOWLEDGE GRAPH


The collecting control room on the R/V Falkor, an ocean exploration and discovery vessel exploring deep-sea biodiversity off Australia's coast.
PHOTO BY PERMISSION SCHMIDT OCEAN INSTITUTE AND WA MUSEUM

Effectively managing and conserving Australia's biodiversity requires the management of an enormous amount of data, information and knowledge about Australia's known species.

Key Asset 3 will be a next-generation, hyper-connected Australian biodiversity knowledge graph. Building on existing national infrastructure such as the Atlas of Living Australia and Australian Biological Resources Study, a biodiversity knowledge graph will help manage and deliver biodiversity information more effectively and efficiently, allow more accurate assessment of trends and patterns in our biodiversity, and ensure that Australia's biodiversity can be safely and effectively used, managed and conserved.

To find out more, see
taxonomyaustralia.org.au/mission-knowledge-graph

Key Asset 3 will provide a next-generation solution to the need for timely, reliable and comprehensive information on Australia's biodiversity for governments, industry and the community.

KEY ASSET 4
TOMORROW'S SKILLED TAXONOMIC WORKFORCE

The mission to discover and document all remaining Australian species in a generation is ambitious and ground-breaking. It will require a skilled, adaptable, innovative and capable workforce that expands to meet demand.

Key Asset 4 will be an integrated national training program at universities and TAFE colleges throughout Australia, and packages of biodiversity resources for primary and high schools. At university and TAFE levels it will focus on training in the new technologies, enhanced methods, and innovative practices that will be needed to achieve the required acceleration.

These skills and the resulting workforce will be highly suitable for this ambitious mission. They will also be adaptable and highly transferrable to many other domains of research, policy and practice in industry, the research sector and government.

To find out more, see
taxonomyaustralia.org.au/mission-training

These four key assets will provide the infrastructure needed to complete the mission, while providing significant early deliverables that will substantially improve the ability of government, industry and the community to manage Australia's biodiversity and its threats, risks and opportunities.

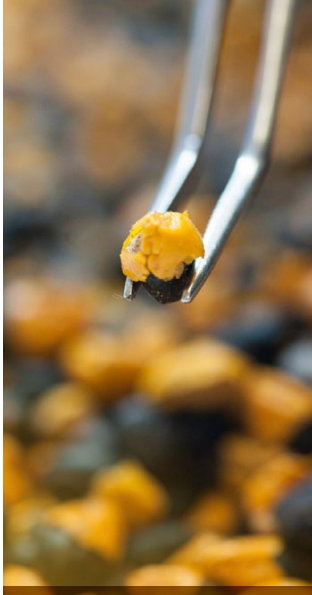
MISSION BENEFITS

Rapid, high-throughput genome sequencing is a key enabling technology for a mission to discover and document all remaining Australian species in a generation.

A preliminary analysis by Deloitte Access Economics estimated that a mission to discover and document all remaining Australian species in a generation will bring between $4 and $35 of economic benefits, during the 25 years of the project, for every $1 invested. The benefits will continue well beyond the life of the project.
The mission will:

- reduce green tape by providing more certainty to the resources sector
- help protect Australia's agriculture and environment from imported pests and diseases by reducing biosecurity risks
- stimulate new opportunities in agriculture, fisheries and aquaculture, pharmaceuticals and environmental management
- help ensure that conservation investments are targeted and effective
- lead to new industries in emerging fields such as industrial food technologies and bioengineering.

To find out more, see
taxonomyaustralia.org.au/deloitte-cba



Australian seedbanks are important repositories for both conservation and genetic research into Australia's biodiversity.
PHOTO: © CSIRO

Australian insects are hyperdiverse and poorly known. An insect sample from a Bush Blitz malaise trap, for sorting.
PHOTO BY PERMISSION REMKO LEIJS, SOUTH AUSTRALIAN MUSEUM

LAUNCHING THE MISSION

Australian fungi are hyperdiverse and very poorly known. This specimen of *Amanita xanthocephala* was collected by citizen scientists from the Fungimap project.
PHOTO BY PERMISSION JOEL CATCHLOVE

There is an urgent need to discover and document Australia's remaining species, to ensure that species are not lost to accelerating extinction before they are even known. All Australian species are potentially important. Any species could be the key to breakthroughs in medicine, agriculture, industry and environmental sustainability.

Australia's taxonomists—the scientists who discover, name and document new species—are ready to launch this mission, with appropriate support from government, industry and the community.

To learn more about taxonomy and the discovery and documentation of Australia's biodiversity, see **Discovering Biodiversity: A decadal plan for taxonomy and biosystematics in Australia and New Zealand 2018–2027**, at taxonomyaustralia.org.au/decadal-plan

Australian Academy of Science

TAXONOMY AUSTRALIA
Discovering our biodiversity

The Ian Potter Foundation

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